*BY ORDER OF THE COMMANDER*

*MAXWELL AIR FORCE BASE INSTRUCTION 48-105*
*18 NOVEMBER 1997*

***Aerospace Medicine***

# *RADIATION PROTECTION PROGRAM*

## COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

This instruction implements AFPD 48-1, *Aerospace Medical Program,* and the As Low As Reasonably Achievable (ALARA) concept in the Air Force Radiation Protection Program for Maxwell AFB and Gunter Annex. This instruction gives guidance for all unit commanders, unit radiation protection officers (RPOs), and all personnel whose duties may involve exposure to radiation. This instruction applies to all military and civilian employees who are potentially exposed to radiation and work in units assigned or attached to Maxwell AFB and Gunter Annex.

### *SUMMARY OF REVISIONS*

This instruction incorporates the new 10 Code of Federal Regulations Part 20 and AFI 48-125. It is divided into two areas: paragraph 2 covers ionizing and paragraph 3 covers nonionizing radiation protection. It updates changes to personnel monitored in the dosimetry program (para 2.4.2); changes to occupational dose limits (para 2.4.3); changes to investigation action levels (para 2.4.4.3); and changes in procedure for TDY personnel (para 2.4.5.5). An ***** indicates revisions from the previous edition.

### 1. Glossary of References Abbreviations, Acronyms, and Terms.

1.1. **ALARA Concept**. The ALARA (As Low As Reasonably Achievable) concept is defined as a set of management and administrative actions taken to reduce personnel radiation doses to as low as possible consistent with existing technology, costs, and operational requirements. The ALARA concept was developed in response to scientific evidence that no level of radiation exposure is totally risk-free. While the established maximum permissible doses are conservative and offer low risks of adverse health effects compared to other hazards of life and occupation, it is prudent that every effort be made to reduce exposures to the lowest level reasonably achievable and, therefore, lower the health risk associated with that exposure.

1.2. **Radiation Protection Officer (RPO).** An individual designated by the commander to manage radiation protection programs. The RPO provides consultation and advice on the hazards associated with radiation and effectiveness of measures to control these hazards. This individual is the most technically qualified person available and should have specific education, training, and experience to assure a capability commensurate with the assignment. Radiation protection officer is a functional title and does not denote any rank or job classification. There are four distinct categories of RPOs:

1.2.1. **Base RPO.** An individual designated by the installation commander to manage the base radiation protection program. The Chief, Bioenvironmental Engineer (BE), is the base RPO at Maxwell AFB and Gunter Annex. The base RPO conducts the base-wide radiation protection program which includes surveillance of all radioactive materials and radiation producing devices. The base RPO coordinates and assists the unit and permit RPOs as necessary to ensure a comprehensive, coordinated radiation protection program.

1.2.2. **Medical Facility RPO.** An individual designated by the medical facility commander to manage the medical facility's radiation protection program. The base BE is the RPO for the 42 Medical Group.

1.2.3. **Permit or License RPO.** An individual designated by the unit commander and approved by the USAF Radioisotope Committee Secretariat or Nuclear Regulatory Commission (NRC) to manage the radiation protection aspects associated with the use of radioactive materials for which a specific USAF Radioactive Material Permit or an NRC license has been issued. (Usually called Radiation Safety Officer (RSO)).

1.2.4. **Unit RPO.** An individual designated by the unit commander to act as a single focal point for radiation protection matters. Each operating unit which operates radiation-producing devices or uses radioactive materials appoints a unit RPO. The

Unit RPO coordinates radiation surveys with the Base RPO, assists in investigations of suspected or actual overexposures, and performs the radiation protection duties

at the unit level commensurate with his or her training and experience.

**2. Ionizing Radiation Protection Program.**

2.1. **General.** The ALARA concept governs the Base Radiation Protection Program. When the term *radiation* appears in this section, it means ionizing radiation or radiation in that part of the electromagnetic spectrum which can produce ions, as well as alpha and beta particles and neutrons, directly or indirectly by interaction with matter.

2.2. **Application.** This applies to all Air Force military and civilian personnel who supervise or work with sources of ionizing radiation or work in areas where exposure to ionizing radiation may occur. This does not apply to the exposure of patients by the hospital during diagnostic or therapeutic procedures, nor does it apply to exposures of personnel to radiation resulting from the employment of nuclear or thermonuclear weapons in combat.

2.3. **Policy.** The Air Force policy is to maintain exposures to ionizing radiation ALARA. There should be no exposures to ionizing radiation without an expected benefit, and the dose received should be the lowest possible, consistent with the state of technology, costs, and operational requirements. Radiation exposures should be kept as far below permissible standards as possible.

2.4. **Requirements.**

2.4.1. **Overview.** The ALARA program requirements contained here apply to all functional areas where radioactive materials or radiation producing devices are used. Whenever the generic term RPO is used, it refers to any or all of the categories of RPOs. Each RPO performs the required tasks for his or her specific area of responsibility. The base RPO should coordinate with the respective functional area RPOs to ensure a comprehensive, coordinated base-wide radiation protection program.

*2.4.2. **ALARA Program Requirements for the Personnel Dosimetry Program.** The base RPO manages the personnel radiation dosimetry program for all functional areas using the guidance established in the Armstrong Laboratory, Occupational and Environmental Health Directorate (AL/OE) Instruction Manual. The personnel in the following areas are routinely monitored with thermoluminescent dosimeters (TLDs).

| Area | Location | TLD Type | Exchange Frequency |
|---|---|---|---|
| A | 42 MDG Radiology | Collar, body | Monthly |
| B | 42 MDG Biomed. Equip Repair | Collar, body, ring | Quarterly |
| E | 42 MDG Dental X-ray, Maxwell | Body | Quarterly |
| G | 42 LG Precision Measurement Equip. Lab | Body | Quarterly |
| H | 908 MX Nondestructive Inspection | Body | Quarterly |
| K | 42 MDG Dental X-ray, Gunter | Body | Quarterly |
| O | 42 MDG Nuclear Medicine | Docs: Collar, body, ring<br>Techs: Body, ring | Monthly |
| S | 42 MDG Surgery | Collar, body | Quarterly |

The Base RPO reviews and signs the dosimetry reports (AL Listing 1499-1, *Current Occupational Radiation Exposure Report*, and AL Listing 1499-2, *Summary of Occupational Radiation Exposure*) when received from AL/OE. The Base RPO reviews and distributes dosimetry reports to the workplace supervisors. The supervisors, in turn, make these reports available to the monitored personnel. On an annual basis, AL/OE prepares and sends the base RPO an AL Listing 1527, *History of Occupational Exposure to Ionizing Radiation*, for each person on the program. These reports are reviewed, signed or stamped, and provided to the workplace supervisors by the base RPO. Workplace supervisors ensure personnel review their exposures, sign the listing, and return a copy to the base RPO for filing.

2.4.2.1. **Pregnant Female Requirements.** Employees confirmed pregnant are monitored on a monthly basis. The base RPO notifies AL/OEBD immediately , who in turn, provides priority processing and notification of the dosimetry results for the identified pregnant workers.

*2.4.3 **Occupational Dose Limits.**

2.4.3.1. Annual occupational dose limits are the more limiting of the following:

- Total effective dose equivalent being equal to 5 rems
- Sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems

2.4.3.2. Annual occupational dose limits to the lens of the eye, skin and extremities are as follows:

- Eye dose equivalent of 15 rems

- Shallow-dose equivalent of 50 rems to the skin or to any extremity

2.4.3.3. Occupational dose limit for pregnant worker is 0.5 rem for the duration of the pregnancy.

2.4.4. **Quality Assurance Requirements.** The base RPO uses personnel dosimetry action levels as a guide in determining surveillance and control requirements. There are four different action levels.

2.4.4.1. **Overexposure Action Level.** A dosimetry result exceeding the maximum permissible dose. A formal investigation and documentation of the incident is required.

2.4.4.2. **Abnormal Exposure Action Level.** A dosimetry result which if continued on an annual basis, would result in an overexposure.

*2.4.4.3. **Investigation Action Level.** The ALARA program requires the Base RPO to set investigation action levels for dosimetry results at which an action is taken to determine the reason for the exposure. The investigation action levels for Maxwell-Gunter AFB are:

| | **Monthly (rem)** | **Quarterly (rem)** |
|---|---|---|
| Total Effective Dose Equivalent | 0.4 | 1.2 |
| Sum of Deep-Dose Equivalent and Committed Dose Equivalent (organs and tissues excluding lens of eye) | 4.0 | 12.0 |
| Eye Dose Equivalent | 1.2 | 3.6 |
| Shallow-Dose Equivalent (skin or any extremity) | 4.0 | 12.0 |

2.4.4.4. **Pregnant Female Action Level.** A dosimetry result if continued for the term of the pregnancy, would exceed the 0.5 rem exposure limit for the embryo/fetus. This equates to approximately 0.05 rem per month.

2.4.5. **Workplace Supervisors Responsibilities:**

2.4.5.1. Review the AL Listings 1499-1 and 1499-2 provided by the base RPO.

2.4.5.2. Ensure new personnel are enrolled into the program.

2.4.5.3. Ensure TLDs are stored in the appropriate control area.

2.4.5.4. Ensure all TLDs are available for exchange and report any lost, damaged, or suspected overexposed TLDs to the Base RPO as soon as possible.

*2.4.5.5. Ensure that personnel TDY for less than 90 days use the TLD from their home base. Extended periods necessitate the issuance of a TLD at the TDY location.

2.6. **Radiation Surveys.**

2.6.1. The Base RPO surveys all radioactive materials and radiation-producing devices. The survey is conducted with the Unit RPO as required. Specific items of interest covered during the survey include: review of dosimetry results, adequacy of storage areas, changes in operating procedures and equipment, physical layout of work area, review of radiation training folder, review of leak tests (if required), correct AFTO Form placement, adequacy of reference material as needed, actual radiation measurements, requirements for lead shielding, review of engineering controls, and any other item required in accordance with current health physics practices. The survey findings are forwarded to the organizational commander, unit RPO, and workplace. The final destination of the report is the workplace itself.

2.6.2. Unit RPOs/workplaces supervisors notify the Base RPO of any newly acquired radiation producing sources.

2.7. **Leak Test Procedures.**

2.7.1. Base RPO.

2.7.1.1. Reviews the swipe test results performed by the Unit RPO on the radioactive sources (as required).

2.7.1.2. Maintains copies of swipe results in the appropriate workplace casefile after annotating any pertinent remarks on the swipe results.

2.7.1.3. Forwards a copy of the swipe results to the unit maintaining the equipment.

2.7.1.4. Trains BE technicians to conduct leak tests and swipes as appropriate.

2.7.2. Unit RPO.

2.7.2.1. Ensures swipe samples are collected on the radioactive sources located in his or her area, if applicable.

2.7.2.2. If swipe samples are collected, ensures a copy of the swipe results are forwarded to the base RPO. They are maintained in the workplace casefile.

2.8. **Receiving and Shipping Radioactive Materials.** The base RPO monitors all radioactive shipments and receipts as requested by base Traffic Management Office (TMO) (Packing and Crating). The base RPO may designate fully qualified Bioenvironmental engineering technicians to do the monitoring.

2.9. **Permits, Licenses, and Other Authorizations for Radioisotope Use.**

2.9.1. The USAF Radioisotope Committee Secretariat has one NRC Master Material license and has authorized use under this license to Maxwell AFB and Gunter Annex.

2.9.2. Applications for initial issue, renewal of existing permits, and amendments are submitted through the unit RPO and the base RPO to the Executive Secretary, USAF Radioisotope Committee Secretariat, HQ AFMOA/SGPR, 8901 18th St., Brooks AFB, TX 78235-5217.

2.9.3. It is the permit RPO's responsibility to update the users and supervisors, as needed, of the radioactive materials as required by the permit.

2.9.4. The base Contracting Officer ensures all contracts involving the usage of radioactive materials on base are coordinated and approved by the base RPO.

2.9.5. Non-Air Force organizations that wish to bring radioactive materials onto or conduct operations involving radioactive material on base must submit an application for approval to the base RPO at least 30 calendar days before the planned date for commencement of activities on base. The request for approval includes the following:

2.9.5.1. A description of the proposed activities.

2.9.5.2. The procedures established to ensure radiological health and safety of Air Force personnel and the public while on site and the name of the responsible contractor representative.

2.9.5.3. A current copy of the applicable NRC or agreement state license.

2.9.5.4. The part of the Air Force contract describing the work to be performed at the base and the inclusive dates during which the work is conducted.

2.9.5.5. An acknowledgment that the base RPO can make periodic checks to ensure the contractor is following applicable radiological health and safety practices.

2.10. **Review of Plans of Existing or New Facilities in which Radiation-Producing Devices or Radioactive Materials are Used.**

2.10.1. All plans for modification of facilities or design of new facilities which involve the use of radioactive materials or radiation-producing devices are reviewed by the base RPO to ensure ALARA is considered.

2.10.2. The review process and signing of plans by the BE, who is also the base RPO, is sufficient for this requirement. The pre-design conferences and stages of design review are critical in this process. It is the user's responsibility to inform the base RPO and Design Engineering that the project involves radiation and ALARA must be considered. The base RPO recommends engineering controls (for example, lead shielding), if required, to reduce the radiation exposures to ALARA.

2.10.3. AL/OE can also be contacted for design reviews which are beyond the technical capabilities of the base RPO.

2.11 **Disposal of Radioactive Waste.** Any radioactive material for which there is no useful purpose is termed radioactive waste (RW). The base RPO is responsible for the proper disposal of RW. The RW generator coordinates all actions concerning RW through the base RPO. The RW generator has the responsibility for physical accountability of the RW until it is shipped from the installation for disposal. The Transportation Management Office (TMO) appropriately packs, marks, and labels packages with radiation survey assistance provided by the base RPO. TMO also makes proper arrangements for transportation.

2.12 **Training.** The unit RPO, with the assistance of Public Health or the base RPO, conducts radiation safety training for all individuals working in areas where radioactive material or radiation-producing devices are used. The workplace supervisor ensures initial training is conducted before, or as soon as possible after, assignment to work in areas involving radiation exposure. Annual refresher training is conducted to reemphasize and reinforce training objectives. The level of training should be tailored to the specific category of personnel and the hazard presented.

Documentation of the training (AF Form 2767, *Occupational Health Training and Protective Equipment Fit Testing*) is maintained by the workplace supervisor and a copy is forwarded to Public Health for inclusion in Tab F of the facility casefile. Such training, as a minimum, includes instructions on:

- Risks from radiation exposure
- Health risks to fetus of women who are occupationally exposed to radiation during pregnancy
- Maximum permissible dose limits
- Protective measures required specific to the radiation work performed
- ALARA philosophy and practice

2.13 **Quality Assurance.**

2.13.1. The base RPO conducts an annual review of the base radiation protection program. The review is presented to the Aerospace Medicine Council (AMC) and the Base Air Force Occupational Safety and Health (AFOSH) Council and includes:

2.13.2. A review of all local directives to ensure they are current.

2.13.3. A review of all radiation survey results for the past year to ensure that all required surveys have been performed and documented properly, and that corrective action, if required, has been accomplished.

2.13.4. A review of all personnel dosimetry results for the past year to ensure that adverse trends are noted and appropriate actions have been taken on results that exceed standards or action levels.

2.13.5. A review of all USAF Radioactive Material permits and NRC licenses to ensure currency and compliance with requirements.

2.13.6. An update of the radiation source and radioactive material inventory.

**3. Nonionizing Radiation Protection Program.**

3.1. **General.** This program covers Radiofrequency (RF), including microwave and laser radiation. RF radiation is electromagnetic energy emitted at frequencies from 10 kilohertz to 300 gigahertz. AFOSH Standard 161-9 is the Air Force Standard governing the RF radiation program. AFOSH Standard 161-10 is the standard governing the laser radiation program.

3.2. **Radiofrequency Radiation.** RF radiation covered in this program originates from communications and radar systems as well as commercial, industrial, and medical devices. Air Force policy is to identify and practically eliminate undesirable RF radiation and associated hazards from Air Force electronic equipment. RF radiation protection program responsibilities include:

3.2.1. The commanders of the units with RF emitters appoint unit RPOs for RF radiation in writing and notify the base RPO and Public Health of the appointment and subsequent changes.

3.2.2. The base RPO is responsible for compiling and keeping a current inventory of all Air Force-owned or operated RF emitters on base, conducting periodic hazard evaluation of each RF emitter, communicating with unit RPOs, and conducting investigations of incidents of alleged or actual overexposures to RF radiation.

3.2.3. The base RPO ensures annual surveillance of microwave ovens used in occupational workplaces (for example, food preparation facilities, etc.) where personnel may be exposed for an extended period of time.

3.2.4. Public Health provides occupational health training on RF radiation when requested by Unit RPOs or commanders.

3.2.5. All unit RPOs who have personnel working in the vicinity of RF radiation emitters educate their personnel on the unit RF radiation sources, safety procedures, and actions to be taken in the event of an accidental overexposure.

3.2.6. Unit RPOs prepare unit operating instructions (OIs) to identify and control personnel access to areas that may produce hazardous levels of RF radiation. The unit RPO sends unit OIs to the base RPO for review before actual implementation or publication of procedures in the OIs.

3.2.7. All personnel working with or near RF radiation must know how to eliminate or reduce RF exposure and know the actions to take in the event of a suspected RF overexposure.

3.2.8. AFOSH Standard 161-9 describes the program in detail. The Unit RPO uses the AFOSH Standard or contacts the Base RPO for additional information.

3.3. **Laser Radiation.** It is Air Force policy to not permit exposure of personnel to laser radiation exceeding the permissible exposure levels. The laser radiation protection program responsibilities include:

3.3.1. Unit commanders establish procedures to notify the base RPO of each laser installation, new laser, or laser modification.

3.3.2. Unit commanders control laser operations to preclude exposure of personnel without appropriate protection to levels of laser radiation exceeding the protection standard.

3.3.3. Unit commanders ensure that areas containing hazardous levels of radiation are posted, and the lasers are labeled according to their hazard class as recommended by the base RPO.

3.3.4. The base RPO is responsible for compiling and keeping a current inventory of all lasers and laser equipment, conducting periodic health hazard evaluations, determining the class of the laser, and conducting investigations of incidents of alleged or actual overexposures to laser radiation.

3.3.5. Public Health is responsible for managing the occupational health examination program for laser radiation.

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